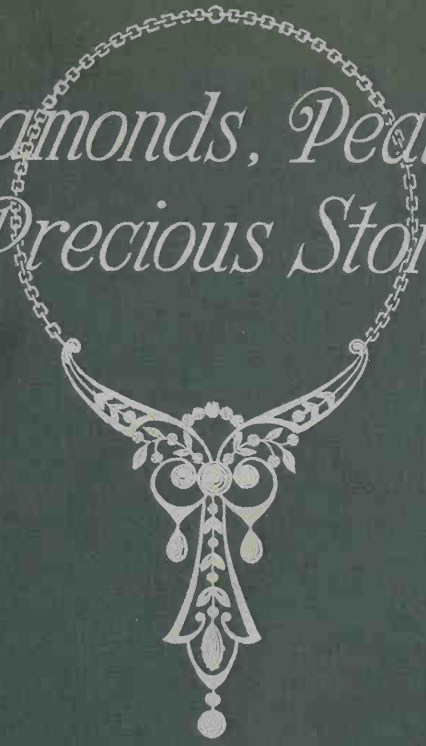
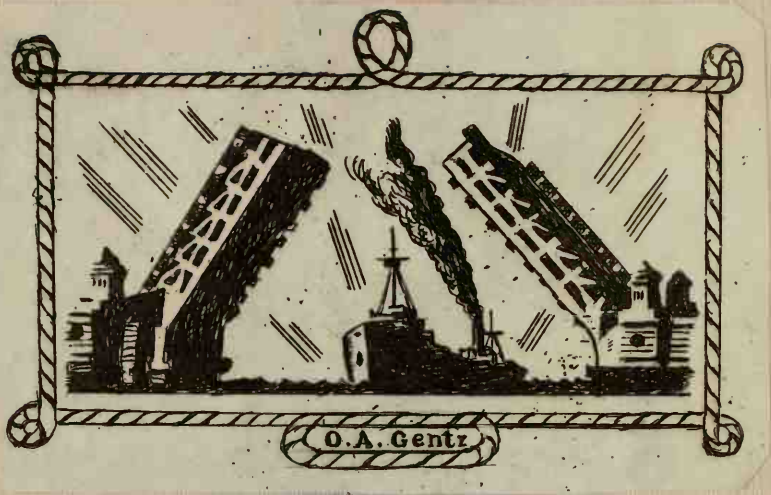
Diamonds, Pearls, & Precious Stones



By
Marcell N. Smith


O. A. Gentz

Gaspar, Krueger, Mory Co.
772 N. Water St.
Milwaukee, Wis.

DIAMONDS, PEARLS *and* PRECIOUS STONES

WHERE THEY ARE FOUND, HOW CUT, AND MADE READY FOR USE IN THE JEWELER'S ART, THEIR COMPOSITION AND VALUE

By

MARCELL N. SMITH

WITH SIXTEEN ILLUSTRATIONS

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To Our Customers

whose loyal support for more
than thirty-five years has
been a constant help in our
endeavor to serve them better

Preface

The purpose of this book has been primarily to give assistance to the employees of the Smith Patterson Company in understanding more fully the diamond, pearl, and colored gem business by giving them, in a condensed and accurate form, information that the writer considers useful. Although he is aware that many larger works already exist which cover the field in a most excellent and comprehensive manner, yet from the very fact that there is such an excellent body of gem literature, it is often hard to obtain a concise and accurate idea of the most interesting points in this field without the labor of extensive study.

The object of the writer has been to present the most important facts concerning the nature of diamonds, pearls, and other gems, and the most interesting aspects in the work of discovering and cutting or preparing gems for the arts, and to give such facts as will be of interest not only to the man in the business, but also to many admirers of precious stones.

In preparing the following pages the works of many authors have been drawn from. In particular the writer acknowledges valuable assistance from:

"Diamond Mines of South Africa," by G. F. Williams. "A Book of Precious Stones," by Julius Wodiska. "Precious Stones and Gems," by E. W. Streeter. "Gems and Gem Minerals," by Dr. O. C. Farrington. "Hand Book of Precious Stones," by M. D. Rothschild. "Gem Cutter's Craft," by Leopold Claremont.

He is also under obligations for valuable assistance rendered by Mr. Ernest G. H. Schenck, Mr. Ludwig Nissen, Mr. Henry Kryn, Mr. Lucien Zell, Mr. Joshua W. Mayer, and to his son, Nelson H. Smith, for aid in preparing the volume; and to Messrs. Schenck & Van Haelen for original photographs of their cutting establishment; Mr. Julius Wodiska for assistance and illustrations from "A Book of Precious Stones"; Mr. Meyer D. Rothschild for assistance and illustrations from the mines of the American Gem & Pearl Co.; J. B. Lippincott Co. for illustration from W. R. Cattelle's book, "The Pearl"; G. P. Putnam's Sons for colored illustration, "Emeralds from Muso Mine."

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The Diamond

The diamond is composed solely of pure carbon and is the hardest substance known, being No. 10 on the Mohl scale. It is found in South Africa, Brazil, India, Borneo, in the Ural Mountains, and in the United States.

The ancient supply of diamonds came probably from India. Although we hear of diamonds in very early times, yet the ancient Indian mines were apparently the first source of supply and continued so until diamonds were found in Borneo, which was only in small amounts, and later more largely in Brazil. The Brazilian mines were discovered in 1727 and were later mined extensively. Mr. Edwin W. Streeter, the London jeweler, in his book published in 1879, states that about 1845 there were twenty-five thousand people engaged in diamond digging in Brazil.

Brazilian Mines

In South Africa diamonds were first found in 1867. The first diggings — they could hardly be called mines — were along the Vaal River. These river diggings were of considerable extent,

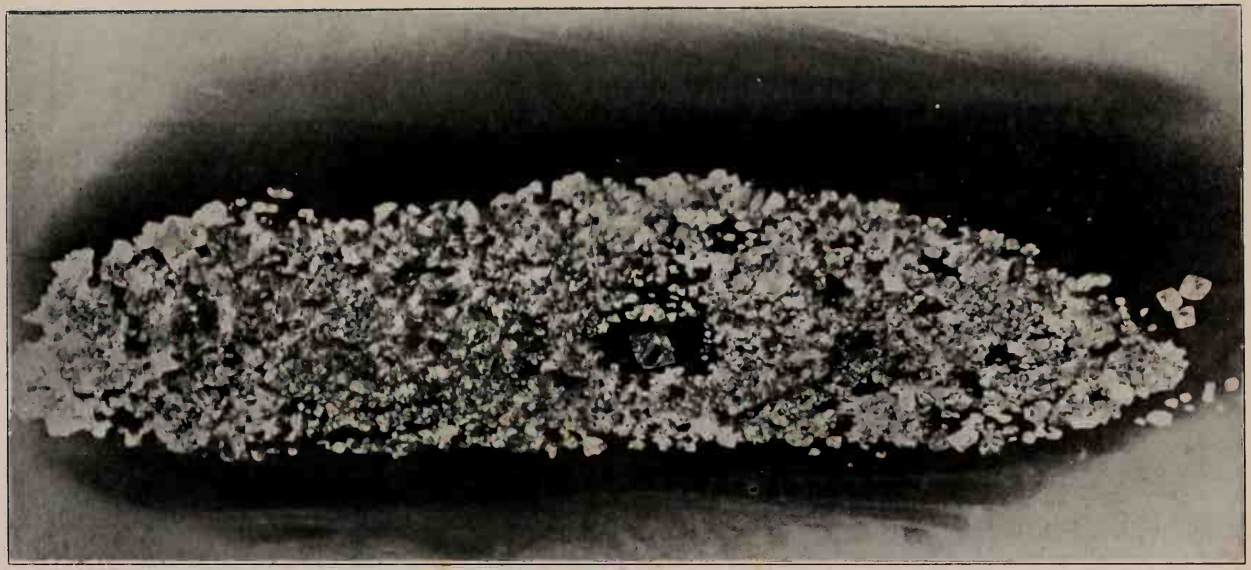
South African Mines

and a large number of miners from all parts of the world were engaged in searching for stones. Their methods, however, were very crude. The famous rush to Kimberley began in 1870, when a fine fifty-carat diamond was found on the Jagersfontein farm. The thrifty widow who was then the owner of the farm let the right to dig diamonds at £2 per month for a claim of twenty feet square. Important diamonds were next discovered on the Dutoitsfontein farm, and soon diamonds were also found on the Bulfontein farm located just across the highway.

Kimberley Mines

The Kimberley mines were discovered in 1871, and the DeBeers and Wesselton about the same time. It is needless to say that the system of leasing claims did not last very long, and that these various farms were soon bought by miners. For some time, however, the various claims were worked by one or two men to each claim, then by larger partnerships, and later by large French and English mining companies.

In 1872 Cecil J. Rhodes, then a student at Oxford University, on account of ill health went to South Africa. He went first to the plantation of his brother, Herbert Rhodes, who had also become interested in diamond mining. A



ONE DAY'S DIAMOND WASH AT THE KIMBERLEY MINES

year later he joined his brother in his mining ventures. This same year, 1873, Barnett J. Barnatto came from London to join his brother, Henry, at Kimberley, as a buyer of rough diamonds. Both Rhodes and Barnatto soon acquired some property and became interested as small mine owners. They increased these holdings rapidly, until after a time both saw the need of combination in mine ownership and especially the need of scientific management in operating the mines. In 1888, they, with Messrs. Rothschild, Alfred Beit, and other able mining men, formed the DeBeers Consolidated Mines, Ltd. Since the formation of this company the mines have been developed along scientific lines by an extremely able management, resulting in great benefit to the company and also to the world.

The DeBeers Company

Since the formation of the syndicate the price of the gems has never been allowed to break, — even in times of the greatest commercial depression. In the early days of diamond mining, on the other hand, and especially in India and Brazil, prices sometimes fluctuated very widely. Mr. Streeter, as an example, states that at the time of the commercial crisis of 1857 the prices of Brazilian diamonds fell to one half that of the year previous.

The Indian diamonds also fluctuated greatly in price according to the supply and the demand.

Indian Mines

The diamond mines of India were principally in the vicinity of Golconda. They were of such importance that in 1669 the traveler Tavernier reported that sixty thousand men were employed in the work. Now, however, this field is practically abandoned, and diamond mining in India is at present carried on only on a small scale by families who do the work in a very crude fashion. Nevertheless, from the ancient Indian mines came many of the famous diamonds of the world: the Kohinoor, the Great Mogul, the Blue Hope, and others.

The Brazilian mines, which were practically only river diggings, were originally government property and were worked mainly by slaves. The slaves, while constantly watched and severely punished if detected, still managed to secrete and steal a large percentage of all the diamonds found. The Brazilian diamonds were practically all small stones, very few being above fifteen or twenty carats *in the rough*. Some were very fine, while others were quite poor. The supply from Brazil at first frightened the Indian miners and reports were spread that the Brazilian stones were simply the refuse of the Indian mines shipped to Brazil. The

Brazilian Diamonds

Portuguese of Brazil, however, effectually turned the tables by shipping their diamonds to India, where they were sold as Indian stones at the market price. The height of the Brazilian mines appears to have been reached about the years 1861 to 1867. During that period there were shipped from Diamantina about ten million dollars' worth of rough diamonds.

Workmen in South African Mines

In comparing the mining in Brazil and India to that in South Africa, it will be noted that, not only does the diamond mining in South Africa stand on a much higher level, in that the mines are worked by the most up-to-date appliances and machinery, but also that the men employed in the mines are very carefully watched to prevent theft. These employees, mostly natives, — many thousands of the Zulu and other warlike tribes being included, — are all required to sign an agreement to remain three months or more in the employ of the company. After signing this they are carefully examined, first, to see that there is no contaminating disease among them, and they are also thoroughly searched, not being allowed to take with them clothing in which diamonds could be easily secreted, — shoes, for instance, in the heels of which diamonds could be concealed. They are then admitted into the

compound or walled enclosure, within which they must remain constantly during the whole period of their work until they are discharged from the mines.

Life in the Compound

These compounds are some seventeen in number, the largest being at the DeBeers mines, where four acres are enclosed; the walls are ten feet in height and the compound is covered with a fine wire screen to prevent the throwing of diamonds outside to a confederate. The huts of galvanized iron for the workmen are built in the compound, and there is also a swimming pool and other means of amusement, so that the natives, while virtually prisoners within the compound, are well cared for. When they leave the employ of the company they are again searched in the most thorough fashion, being stripped and then placed in a detention room provided only with a blanket. Here they are kept for a period of five to seven days, so that even if the men swallow diamonds it is impossible for them to escape with their treasures. Finally they are given their old clothes, which have been kept in sacks numbered for each man, and allowed to leave the compound.

Treatment of Blueground

The diamonds are found in what is called *blueground*, which when mined is about as hard as sandstone. After being excavated

KAFIR EMPLOYEES GAMBLING IN THE COMPOUND, KIMBERLEY MINES

from the mines the blueground is conveyed to the *floors* — large flat areas — where it is left from three to six months, or more, to soften. These floors are very large, those of the DeBeers and Kimberley mines covering two thousand acres. The blueground on the floors is harrowed by steam traction engines to assist in pulverizing the ground. This, with the action of the sun and rain, finally disintegrates the material so that it can be taken to the washing machines or *pulsators*, as they are technically called. The yield of diamonds per load of blueground is very small, but by the careful and comprehensive methods used, practically no diamonds are lost and the total yield is very large.

Present Condition of Mines

Of the South African mines the Kimberley and DeBeers have until recently produced most of the diamonds. These mines have now been worked so deep, about three thousand feet, that, owing to the heat and danger at that depth, they are at present considered about worked out and comparatively few stones now come from these mines. The Dutoitspan mines are at present the largest producing mines in South Africa, and give very sound material, about the same as that of the Kimberley, DeBeers, and Wesselton. The Bulfontein in point of production is the second largest mine under the DeBeers

control. Its *rough* runs rather small in sizes and is quite imperfect. From the Jagersfontein mine, commonly called Jagers (pronounced *Yāgus*) are found some of the finest blue-white stones in the world, although there are other qualities of stones found there as well. The Premier mine, also controlled by the DeBeers Company, produces some very remarkable stones. From this mine came the famous Cullinan diamond, which weighed in the rough 3,253¾ carats. This stone was of fine blue-white color and remarkably free from imperfections.

The Cullinan Diamond

The gem was bought by the Transvaal Government for £200,000 and was sent as a present to King Edward VII, who entrusted the cutting of the Cullinan to Messrs. Joseph Asscher & Co., of Amsterdam, who received £10,000 for their work. From it were cut, besides several smaller stones, two diamonds, each of which was larger than any other diamond in the world. In the Premier mine was also recently found the second largest diamond in the world, weighing 1,640 carats. This stone was not very perfect and was bought by Mr. Jac. Kryn, of Antwerp, to be cut into small stones. The beautiful deep blue diamonds which were on exhibition in the spring of 1912 at the store of Smith

THE CULLINAN DIAMOND

ACTUAL SIZE IN THE ROUGH

Patterson Company were from the Premier mines. Many other remarkable stones in golden brown, canary, green, etc., are found in the Premier mines.

The Wesselton mines as a rule produce fine white diamonds. The Robert Victor mine, of South Africa, is an independent mine controlled by English capital. The diamonds from this mine are of a very fine color, but are also very imperfect.

River Diamonds

In addition to the regular mines in South Africa diamonds are found in certain rivers. These diamonds are now mined by damming up the river at various points, pumping it dry and dredging it. The river diamonds in the rough can always be recognized by their dull surface, which is accounted for by the scratching due to the constant rubbing against pebbles and other diamonds while being carried down by the stream. River diamonds vary very greatly as to quality.

German Mines

Of the stones found in the mines in the German possessions in South America nearly all are small and practically all are cut into *melees*. They are largely, however, of very good quality, and a large part of the best melees now come from the German mines.

For many years the DeBeers Consolidated

London Syndicate

Mines, Ltd., has sold its annual production to the London Syndicate of diamond merchants, who handle most of the products of the mines of South Africa, with the exception of the German mines. The London Syndicate's methods of conducting business are quite unusual. In general the procedure is as follows. When the managers have a lot of goods for sale they notify the buyers of the rough who are on their list as being entitled to buy from the Syndicate direct, that a "sight of the goods" may be had on a certain date. The buyer must declare his intention and make application some time in advance of the time when a sight of the goods is expected, in order to secure the opportunity to make his purchase. If the favored buyer who is allowed to buy the rough does not then buy, he is omitted from the purchasing list for several months. The goods are sold in lots of some $200,000 in value and upwards, and must be paid for in spot cash. The prices are absolute.

Classification of Diamonds

The goods mined at South Africa are sorted and classified at Kimberley as follows:

1. Close goods
2. Spotted stones
3. Rejection cleavage
4. Fine cleavage
5. Light brown cleavage

6. Ordinary and rejection cleavage
7. Flats
8. Naats
9. Rubbish
10. Boart

Close Goods are supposed to be pure stones of desirable shapes. *Spotted Stones* are crystals slightly spotted. *Rejection Stones* are those seriously depreciated by spots. *Cleavage* are broken stones. *Flats* are flat crystals. The refuse classed as *Rubbish* and *Boart* is polishing material. The first eight classes are supposed to be further subdivided according to shades, as follows:

Classification According to Color

Blue white
First Cape
Second Cape
First bye
Second bye
Off color
Light yellow
Yellow

Only the first grade or close goods are really carefully graded according to these eight shades. With the other grades the sorters are less particular. Each color is again subdivided into several sizes, and when the goods

arrive in London the Syndicate again sorts them into

Finest extra blue white,	Fine Capes
Extra blue white,	Capes
Finest blue white,	Byewaters
Blue white,	Yellows
Finest white,	Finest light brown
White,	Light brown
Silver Capes,	Brown and dark brown

All these colors are divided into shipments of *Closed Goods*, *Spotteds*, *Irregulars*, *Blocks*, *Naats*, and *Flats*.

Colors of Diamonds

While diamonds are found in many colors the usual colors are white and yellow of various shades. The Jagers stones are largely blue white and in the trade blue-white stones are frequently called Jagers (*Yāgus*). The diamonds from the Wesselton mines are usually of fine white color, and goods of this color are generally termed Wesseltons. All Capes and Byewaters have some tinge of yellow. Brown diamonds, if light enough, are quite desirable, and often mount up to better appearance than the best Silver Capes.

Fancy stones of remarkable shades, *Golden Brown*, *Apple Green*, *Deep Blue*, *Canary*, etc., if of fair size, are of much more value than blue

SORTING THE GRAVEL FOR DIAMONDS AT THE KIMBERLEY MINES

white, varying according to the specimen. The most valuable of all diamonds are the red. This color is very rarely found, and there are only a few specimens of it in existence.

Old Mine Diamonds

Old Mine stones are supposed to be fine blue-white or extra fine white stones from the old Brazilian or Indian Mines, and originally were always cut in such a manner as to save the most weight; consequently, they were frequently very thick and of poor shape. Today we hear very little about Old Mine stones, since as fine stones have been found in South Africa as were ever found in the Old Mines, and those that are shown as Old Mine stones are generally "fakes," coming from regular sources.

The Cutting and Polishing of Diamonds

Diamond cutting and polishing originated in India, and the art was afterwards introduced in Italy and in Paris. It had its beginning in Antwerp, about 1480, and also about the same time in Amsterdam. Amsterdam has become famous for its diamond cutting, and for a long time had by far the largest number of cutting and polishing establishments in the world.

Antwerp for some years has had some of the largest establishments, and during the last six years has gained rapidly on Amsterdam, and at the present time has a considerably larger business in the cutting and polishing of diamonds than Amsterdam.

Improvement in Diamond Cutting

Diamond cutting has been carried on in America for fifty years or more, and the cutting of diamonds for the world has been revolutionized through the improvements in cutting made something like forty years ago by Henry D. Morse, of Boston.

Prior to these innovations diamonds were cut

in a nearly square shape, with the corners somewhat rounded off, — the object being to secure as much brilliancy and also to save as much weight as possible. Diamonds are now cut, as every one knows, practically round. The style of cutting may be described as follows:

The Style of Cutting

The *table* on the top of the stone is surrounded by thirty-two small *facets* reaching from the *table* to the *girdle*, or edge of the stone. The back of the stone has a tiny facet at the top of the pyramid, formed by cutting, called the *culet*, surrounded by twenty-four facets reaching from the culet to the girdle. Formerly and even now in most of the ordinary cutting comparatively little attention is paid to the girdle; but the better the quality of the cutting the more attention is paid to the desirability of having the girdle as thin as possible, and yet not so thin as to chip easily. This object is attained in the patented *polished girdle* form of cutting, which has an extra curved facet around the girdle. This cutting is protected by patents in the United States and in foreign countries, and in New England is sold direct only to the Smith Patterson Company.

The Polished Girdle

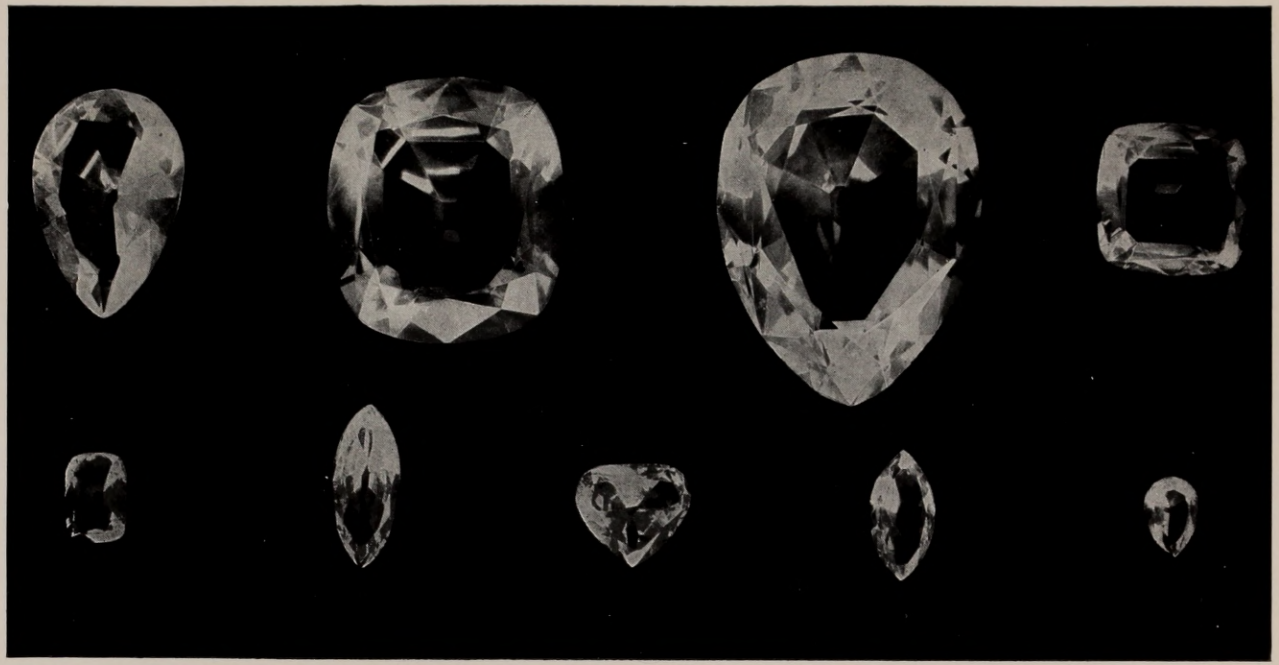
In describing this cutting we will quote a letter of March 14, 1913, from the holders of the patent, Messrs. Schenck & Van Haelen.

"Before its final realization the quest for a Standard of absolute perfection in the cutting of a diamond has been one which ran through centuries of constant endeavor.

"Incidentally it has brought into existence that interesting branch of the trade called 'fancy cutting.' It has been responsible for many sad disappointments and disillusions. Witness in 1885 the short-lived 'Brilliant-Phare,' later revived under the name of 'Twentieth Century,' etc.

"By a stroke of genius the fundamental lines of division governing the now classical cutting called 'Brilliant' were laid down some three hundred years ago by Vincent Peruzzi, in Venice. The cutting at that period was done in crude and primitive fashion, but it paved the way towards the present high achievement.

"The latter-day Renaissance in the art of diamond cutting, credit for which is entirely due to the keen appreciation shown by the discerning lovers of jewels in the United States of America, has through gradual stages of advancement developed the possibilities inherent in the 'Brilliant,' and has culminated in the production of an ideal stone, the cutting of which is covered by patents in the United States and in the principal foreign countries.



THE CULLINAN DIAMOND

ALL THE STONES ILLUSTRATED WERE CUT FROM THE CULLINAN DIAMOND AND ARE HERE SHOWN HALF ACTUAL SIZE

Why the Polished Girdle is Best

"The superiority of this diamond resides in its dominant feature: The polished curved facet encircling the edge of the stone, forming a continuous narrow girdle, establishing in harmony with every detail of its cutting a connecting link joining all its facets into one final attainment of perfection.

"This patented Polished Girdle, with its resultant increase in luster and brilliancy, produces a maximum diffusion of light with corresponding depth of attraction.

"The smooth finish of the edge protects the patented Polished Girdle diamond against injury by 'chipping,' — an advantage that both setter and wearer will appreciate.

"The Polished Girdle of this diamond furthermore provides efficient means of identification; the cylindrically shaped facette acting as an indelible hall-mark embodied in the stone.

"It is indisputably the first and only perfectly finished brilliant, — a Standard for all time.

"Isolated attempts have been made more recently by some of the followers of Peruzzi to give increased luster to the brilliant by adding to the unfinished stone flat polished surfaces spaced at more or less irregular intervals, disturbing the line of circumference without attaining the desired result. It is superfluous to point

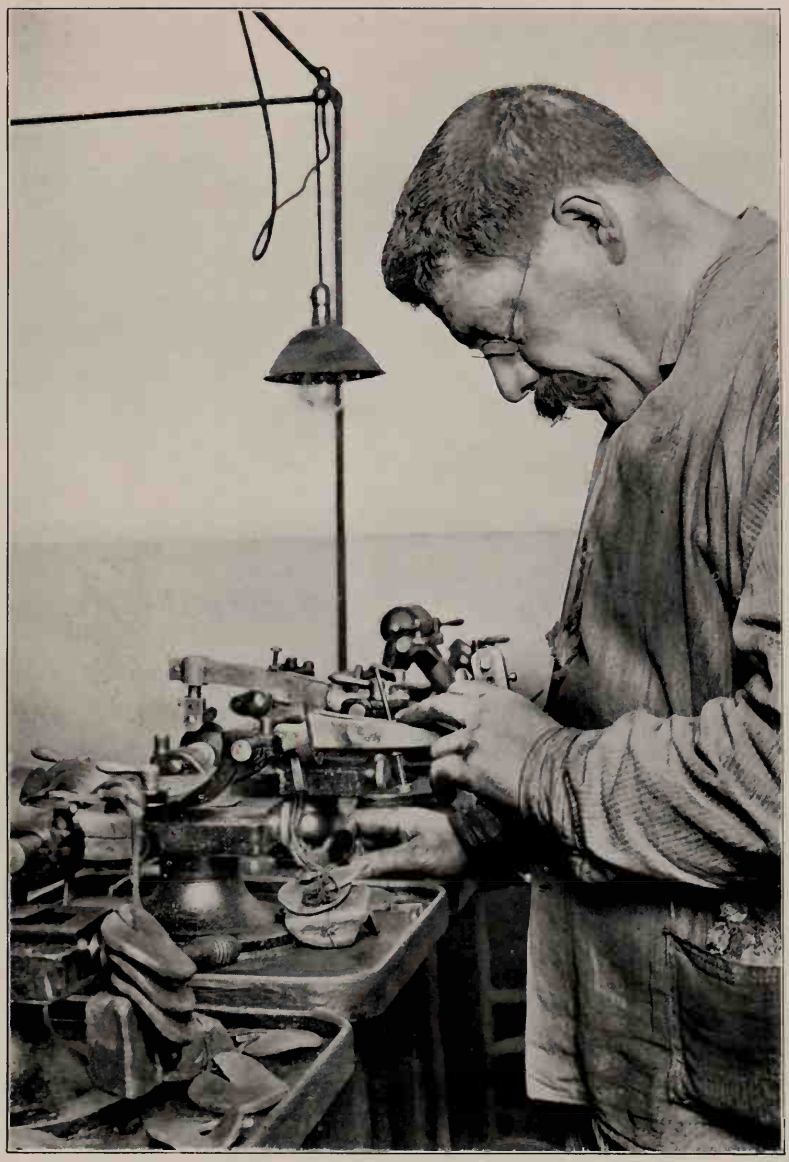
out that such makeshifts destroy their own ends.

"To the expert jeweler and diamond dealer, no further explanation is necessary to make him realize the advantages and superiority of the patented Polished Girdle diamond.

"The person more likely to be in need of guidance and information is the purchaser not thoroughly conversant with the art, and who, wishing to ascertain points of recognition, relies upon his confidence in the knowledge of experienced jewelers."

Proportions of Correctly Cut Diamond

A properly cut diamond should have fifty-eight facets if regularly cut, and fifty-nine if cut as a patented polished girdle. One third of its size should be above the girdle and two thirds below, and the table should be two fifths the diameter of the stone. These are the correct proportions to secure the greatest brilliancy. A stone cut too *deep* (that is, too thick) lacks brilliancy, and one too shallow becomes flat in its effect and in the trade is termed a *Fish-eye*. In the cutting of the finest diamonds much consideration is now given to the girdle, while on the other hand many ordinary stones are cut with thick, rough girdles, which results in more weight being left in the stone and less expense to manufacture per carat, consequently a lower price to the



THE DIAMOND SAW

THE SAW WITH DIAMOND BEING SAWED IS SEEN AT THE LEFT OF THE BENCH

customer by the carat. But it must be remembered that a poorly cut stone will not look as large as a stone of slightly less weight, if the latter is well cut.

Fine diamonds, especially those of considerable size, are cut into *drop shapes*, *navettes* or *marquise shape*, *square cut* or *emerald cut*, *square cut with steps*, and *oval*, the last being cut like a round brilliant, but of oval shape. Small pieces from the processes of cleaving and sawing diamonds are generally *rose cut*, with flat back. It is due probably to this fact that the rose-cut stones come from the fragments that they are commonly termed *chips*. In the old days of cutting many of the famous stones were *rose cut*, having when properly cut twenty-four facets. A correctly proportioned *rose* should be one half its diameter in thickness. Smaller and poorer *roses* have twelve facets.

Before being cut the rough diamonds are first examined by an expert, who decides how each stone shall be treated, and who then marks on the stone with ink what part of the stone shall be removed by cleaving or sawing, in order to get it in proper shape for further work.

Diamond Cleaving

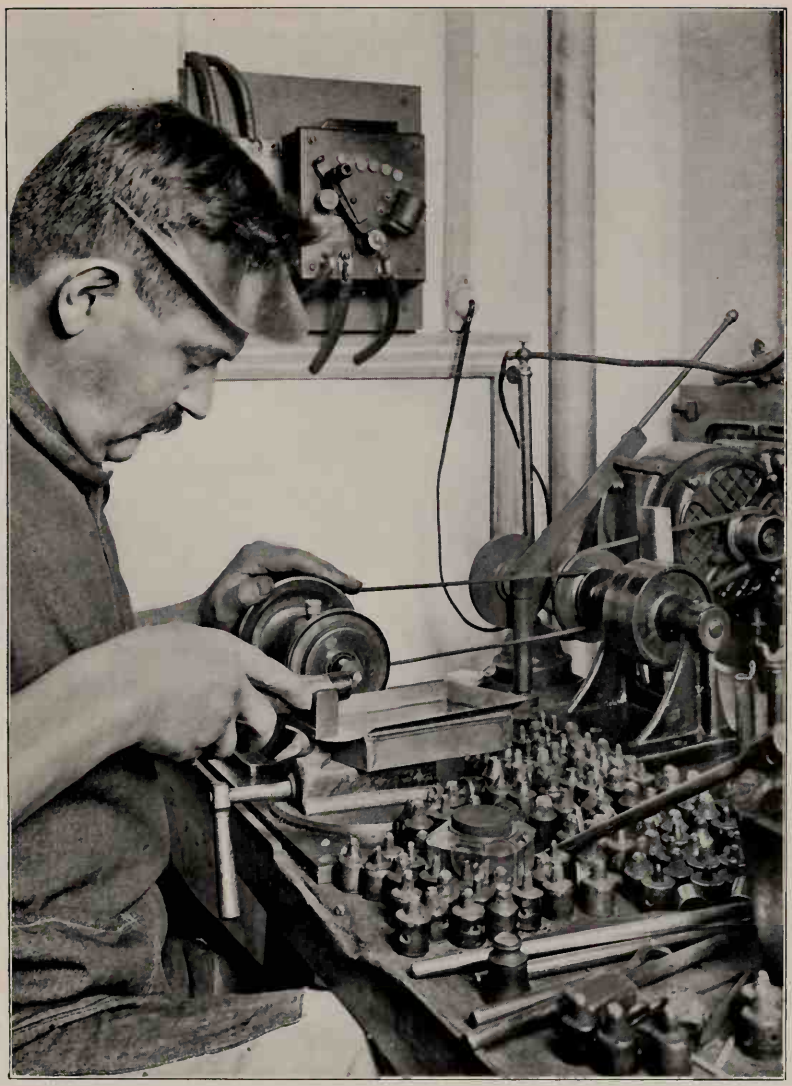
In the process of cutting, rough diamonds are generally cleaved or sawed to render them suitable in size for cutting. If it be cleaved,

the rough diamond is fastened with cement to the end of a wooden holder and a tiny groove is scratched with another diamond on the stone at the point where it is to be cleaved. The stone is then held by the clamp in correct position, and then a heavy steel blade is placed on the diamond, and this blade is struck a smart tap on the back and the stone divides along the line previously determined. The operation seems very simple, but is one that requires excellent knowledge of the stones as well as experience.

Diamond Sawing

Sawing has been used some twenty years or more, and enables the cutter to divide the stone along any plane, independent of its structure, while a diamond can be cleaved only along its natural cleavage lines. The diamond saw is about three and one half inches in diameter, and consists of a very thin piece of a special alloy, the edge of which is treated with diamond dust. The work is done very slowly, several hours being required to cut one diamond, so that one workman operates a large number of saws at the same time.

After being cleaved or sawed the stone is again examined by an expert, and a plan for further work on that particular stone is determined on. The most important point in this is



THE CUTTING OF A DIAMOND

ONE STONE IS SEEN IN THE LATHE, WHILE THE OTHER IS FIXED IN THE END OF THE TOOL HELD BY THE WORKMAN

the location of the table, which when decided upon is marked with an ink circle.

Diamond Cutting

The next step in the process is that called *cutting*. This work was done entirely by hand, and was called *bruiting*, until about twenty-five years ago, when machine cutting came into use. In machine cutting a rough diamond is fixed by cement in a steel holder held in a lathe and is cut by another diamond, which is also fixed into a steel holder attached to a handle some eighteen inches long, this latter diamond being held against the one in the revolving lathe and the cutting done much after the manner of wood turning. The stone is cut very rapidly as compared with the old method of *bruiting*, the method which had been used from the time of the first cutting of diamonds until the advent of machine cutting. Machine cutting, however, can be used only for round and oval diamonds, and for the round ends of pear or drop shape diamonds. Marquise shape, square or emerald cut, and other fancy shapes must still be cut by hand.

Diamond Polishing

Diamonds are polished on a *polishing wheel* covered with diamond dust and oil. The wheel is about eleven inches in diameter and made from a special casting of a secret alloy known only to two men, one in Amsterdam and one

in Antwerp. The wheel is set to revolve horizontally at the rate of about twenty-two hundred revolutions per minute. The time needed to polish a diamond, say of about one carat, after it has been shaped up ready for the wheel, is, depending on its hardness, from two to four days.

Method of Holding Diamond Polisher

The diamonds to be polished were formerly always imbedded in a composition of lead and tin while the metal was in an almost fluid state. In this case the workman sets the stone in position at the proper angle with a pair of pliers and smoothes the still almost molten metal with his bare fingers. It seems to the observer that it is a miracle that the man does not burn his fingers, until it is noticed that they have been calloused by the hot metal to a condition almost like that of leather.

After each facet has been polished the diamond must be removed and reset before a new facet can be begun. The patent *dop*, invented about seventeen years ago, which allows the stone to be set at the desired angle and held by clamps, is about the only improvement in the process of polishing for many years. This improvement cannot, however, be used in the polishing of *melees*, *marquise*, *square*, and other fancy-shaped diamonds in which the

THE DIAMOND POLISHER'S WHEEL

THE WORKMAN IS ADJUSTING THE *dop* CONTAINING A DIAMOND PREPARATORY TO POLISHING

old-fashioned *dop* of soft metal must still be used.

The Perfect Diamond

By a perfect diamond is meant in the trade a diamond without flaw or spot which can be discovered by using an ordinary watchmaker's glass by a person whose eyes are ordinarily strong. Scientifically the perfect diamond does not exist, as all diamonds must show imperfections if a glass powerful enough be used. Imperfections, termed *flaws* or *feathers*, are due to carbon spots or minute cracks. Commercially, perfect diamonds or slightly imperfect and even imperfect diamonds are equally staple and salable. The actual value of the stone is of course determined by its color, brilliancy, freedom from discernible imperfections or conspicuousness of flaws if they exist, and size.

Can Diamonds be bought best from European Cutters or American?

The question often comes up whether diamonds used in the United States can best be bought by diamond merchants from cutters in America or from the cutters in Europe. To those who have made a study of the question there can be no doubt that in sizes from one half a carat and larger, the American cutters, if properly equipped, are able to produce and deliver finished diamonds to the trade in the United States cheaper than the same goods

could be bought and landed, duty paid, from European cutters. The following letter from Mr. Ernest G. H. Schenck, of Schenck & Van Haelen, explains the condition of the cutter in America and Europe as it is today.

"Regarding wages ruling in American as against European diamond cutting centers, the difference which some fifteen years ago existed and had a bearing upon preference of purchase being given to Europe, has today become so small a factor that the tables have been efficaciously turned in favor of the United States for all purchases of diamonds of value and size, not excluding some *melees*.

Better Workmanship

"The progress made here in economic handling of rough merchandise has almost reached the point where, should the duty be removed from the cut as well as it is removed from the rough diamond, I firmly believe the industry would, in the United States, through better workmanship, triumph and grow over all others, even on an equal footing.

"Several causes lie at the bottom of this: fifteen years ago the cost of manufacture represented, say, about fifteen per cent of the price of the finished article; today, with the doubled value of the rough material it represents only about ten per cent (allowing, of

course, fully for increased wages paid for improved work during that period).

"Furthermore, if some dozen years ago, at a time when protection to industries was thought necessary, an average duty of less than ten dollars per carat (ten per cent ad valorem) was found more than sufficient, what is the obvious conclusion to be drawn today, when this same duty means on the same goods not less than double or twenty dollars per carat?

Trades Unionism

"On the other hand, trade unionism has increased in Europe even more and with greater reason than it has in the United States; and the demands have become more urgent in full ratio to the abuse of labor that has been practised in the old countries. The result has been that the few good artisans who had not emigrated to more hospitable shores, together with the mass of poor workers remaining over there, have gradually found better terms granted them, with shorter hours of work, than had ever been the case heretofore. In consequence there is today a constant narrowing down of the difference between the two scales of wages, and it will not be long before almost equal compensation will prevail in Antwerp and Amsterdam, as well as in America, for the best workmanship in diamond cutting.

"In a general way, this wage question could heretofore be summed up as follows, taking two hundred dollars as an average value per carat:

1 Carat, $200.00 U. S. A...	paid wages	$20.00
1 Carat, $192.00 Europe...	paid wages	$12.00
	Difference	$8.00

or four per cent in favor of Europe.

"Duty ten per cent on $192 is $19.20, from which, deducting balance in favor of Europe equaling $8, leaves $11.20, or 5.6 per cent in favor of the United States.

"With the going into effect of the new Underwood Tariff this percentage of difference remains the same, owing to the fact that the ratio in duties between cut and rough diamonds brought into the United States also remains the same, that is, the duty on cut diamonds has been increased to twenty per cent, whereas the duty on rough diamonds is now ten per cent ad valorem."

Melees Melees and sizes smaller than one half carat can, however, be cut in Europe and landed, with twenty per cent duty, cheaper than they can be cut in America. The statements of Mr. Henry Kryn and other diamond cutters regarding the cost of labor per carat in the United

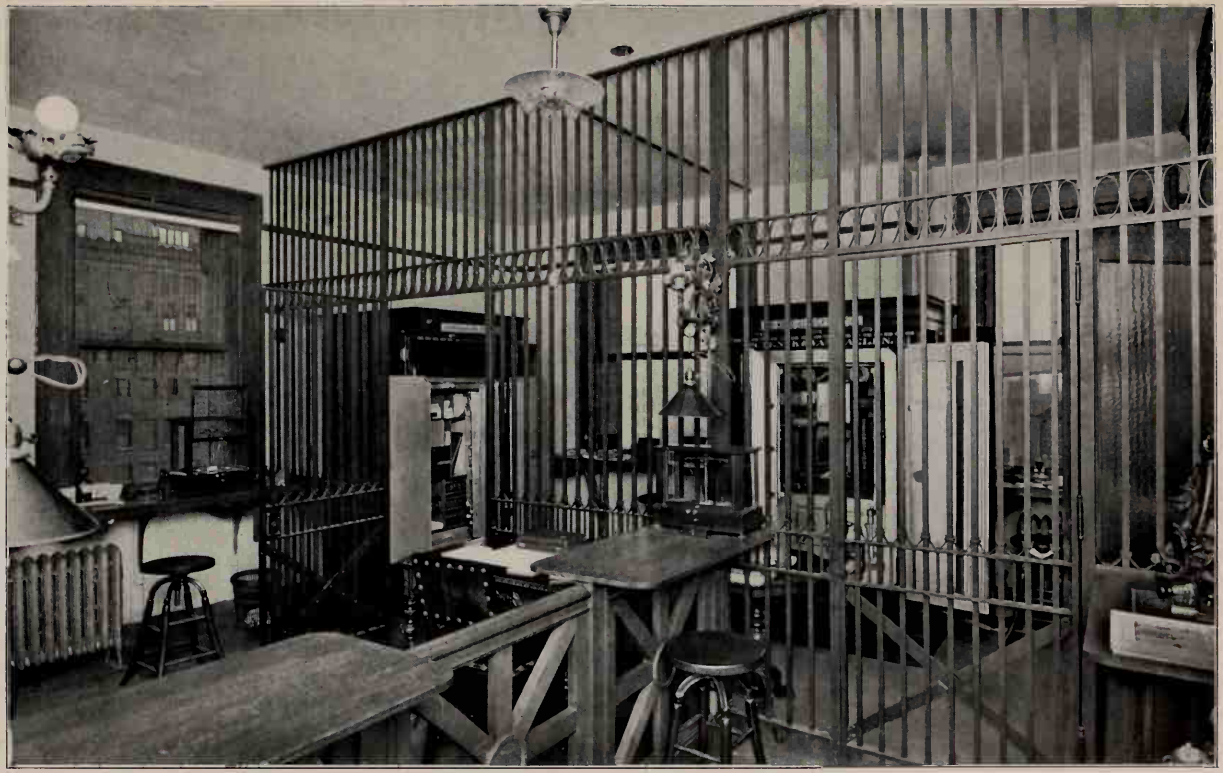
States and Europe, while slightly different from those of Mr. Schenck, show conclusively that Mr. Schenck's statement regarding the difference in cost of American and European cut goods, after the duty has been paid in the United States, is correct.

Advance in Price of Diamonds

Diamonds have, since 1898, steadily advanced in price and are still advancing. This is due, we believe, first to the difficulty in actually mining the world's supply of diamonds, and second to the fact that through the methods of business of the two great companies, the DeBeers Consolidated Mines, Ltd., and the London Syndicate, — which combined form virtually a monopoly, — they have been able to control the entire diamond market and to regulate prices. For many years these two companies have made the diamond market secure and undoubtedly will continue to hold it so. The extent of the rise in prices has, meanwhile, been very great, and in a rough way it is safe to say that diamonds are today worth more than double the value of the same goods in 1898, and in many cases more than three times what they were worth at that time.

Perhaps the greatest advance in this general rise in value has been on fine crystal or Wesselton *two grainers*, or half-carat diamonds, which

have advanced to more than three times their value in 1898. Silver Capes and the best of the cheaper goods have advanced rather more than blue white and Wesseltons, except in the half-carat sizes of the latter.



OFFICE OF A DIAMOND-CUTTING ESTABLISHMENT

SCHENCK & VAN HAELEN, NEW YORK

Diamond Mountings

Platinum Mountings

Diamonds have been mounted into gold jewelry in the richer countries of the world for centuries, but an examination of the collections of old jewelry in the great museums of the world will convince any one that this ancient work is of interest and value only to the student of antiques. These ornaments were invariably of gold. In work of a more recent date, platinum, although used to a limited extent for about thirty years, has been used to a marked degree only since about 1900. In the evolution of present-day diamond jewelry, however, platinum has been the metal which has increased steadily in favor, until it is now practically the only metal used for the most elaborate and artistic creations. Platinum was discovered in South America in 1735 and in Russia in 1819. It has also been found in Canada and Australia. About nine tenths of all produced in the world now comes from Russia. Very little, however, is found, only about one per cent of platinum since its discovery in proportion to gold found

in the same period. It is generally found in the sand of placer mines and the usual yield is one ounce of platinum to a ton of sand.

For use it must be alloyed with iridium and when properly alloyed is very hard and retains a fine brilliant finish. As iridium is far more expensive even than platinum, some manufacturers, in order to secure platinum at lower price, have not used enough iridium in their alloy, which has resulted in the metal becoming soft and turning dull or leady in color. Platinum of standard hardness of alloy weighs nearly sixty per cent more than fourteen-carat gold, and while fourteen-carat gold costs sixty-four cents per pennyweight, platinum now costs about $2.50 per pennyweight.

Comparison of Cost of Material in Mountings

In computing as an example the value of a diamond mounting, it might be said that a diamond mounting weighing ten pennyweights would cost for the gold $6.40; a mounting of the same size in platinum would weigh nearly sixteen pennyweight and cost nearly $40 for the material.

The cost of working platinum is also far greater than that of gold, but its brilliant finish and hardness and harmonizing color make it far the best metal for fine diamond and pearl mountings.

It need hardly be added that the finest creations in diamond mounting can only be produced by artists who combine a knowledge and appreciation of the finest epochs and styles in the art of ornamentation, with the marvelous technical skill of the best of the present-day craftsmen in platinum and precious metals.

The Pearl

Oriental Pearls

Pearls are in a sense the purest of all gems, since they alone require no polishing or cutting at the hands of workmen, but are found in nature in their most finished form of perfection. They have been known and prized since long before the Christian era. They are said to have been known in China four thousand years ago. The gems occur more or less extensively in almost every country where oysters or mussels are found. The pearls of the greatest value are the *Orientals*, found in the Indian and Pacific oceans. The famous fisheries of Ceylon furnish a large percentage of fine pearls, although the gems found there are seldom of large size. The Ceylon oyster is comparatively small, only about four inches in length and with a thin shell, while the oyster of the South Seas, Australia, and the Philippines is very large and thick. From these large pearl oysters comes the beautiful *Mother of Pearl* much used in commerce.

The fresh-water pearls are found in streams,

lakes, and ponds in nearly all parts of the temperate zone. American fresh-water pearls are found largely in the Western rivers, and are generally of irregular shapes, either *button* or *baroques*, although some fine pearls have nevertheless been found there. In fact, some very fine American pearls have been discovered which have commanded a very large price. *Fresh-Water Pearls*

The value of a pearl depends first on its luster or *orient*, as it is termed in the trade; second, on its *shape*, round being the most valuable, next drop or pear shape, and lastly on its texture or *skin*. The skin of a fine pearl should be free from any wrinkles, scratches, or spots. Pearls increase in value in proportion to an increase in size much faster than does any other gem, and are figured unlike any other gem. For instance, if *Value of Pearls*

A one-grain pearl at $5.00 base is valued at $5.00.
A five-grain pearl at $5.00 base is worth $125.00.
A ten-grain pearl at $5.00 base is worth $500.00.

For a long time pearls have had a far greater sale in Europe than in America. All jewelers of much prominence abroad carry very large stocks of pearls. But the pearl business in America is now very large and gives every promise of increasing greatly in the future.

Increase in Value

The increase in value of pearls has been going on during the last twenty years very rapidly, and the increase has been far greater than is the case with diamonds or even with emeralds. The causes for this advance in price are better known than in the case of diamonds, and the probable value of pearls in the future can therefore be more definitely forecasted. Regarding these points I will draw largely from a personal letter from Mr. Ludwig Nissen, of New York:

Average Annual Value of Pearl Fisheries

In brief, then, the cause for the advance in price of pearls is simply that the supply is now absolutely inadequate to meet the demand. The supply is chiefly from two sources, — the fisheries and the accumulated stores of the great Indian rajahs. The fisheries, the only primary source, are gradually being exhausted. In the last five years, statistics show that there has not been an average of ten million dollars' worth of pearls from all the fisheries combined, while much more than ten million dollars' worth of pearls are sold annually in New York City alone. Furthermore, there has not been a new pearl fishery discovered in the last fifty years. This exhaustion of the fisheries has been accelerated by the methods used. In former years divers went down to the bottom of the

THE RAJAH OF DHOLPUR

WHOSE PEARLS WERE VALUED AT $7,500,000

Courtesy of
J. B. Lippincott Co.

sea to pick out and get the oysters which they thought might contain pearls, but since the demand has so largely increased, divers are no longer employed. Grapples are used in their stead and are operated in the same way as dredging machines, scraping up everything, large and small. When these small oysters are opened and *seed pearls* taken, there is obviously no chance for the pearls to grow larger, "on the same principle that where one picks a peach blossom, one cannot pick a peach." In this manner the pearl fisheries are being robbed instead of being conserved, and the supply must continue to decrease. *Pearl Fisheries*

Drilled pearls are practically the only ones found on the European market today, and this fact points to the second source of supply. These drilled pearls are old pearls gradually accumulated and held for centuries by the pearl-loving princes of India. New pearls from the fisheries are never drilled, both because the gems may be desired for other purposes than for necklaces, and also because the moisture otherwise held within the hard outer skin can, in the case of drilled pearls, ooze out between the skins, the pearl little by little dries up and becomes lighter. The old pearls of the Indian princes were always drilled so that they might *Drilled Pearls*

be strung and thus carried with greater security by the owner. The fact that most of the pearls on the market are drilled shows again that we are dependent for our supply on these accumulations which are the result of centuries of pearl fishing, and until four or five years ago large numbers of these old pearls were lured from their ancient owners by the large prices offered. But now even this supply, limited as it must be, is beginning to dwindle. Lastly, great difficulties are now encountered in securing pearls from these sources. A pearl syndicate has been formed which collects all the pearls it can secure in all parts of the East, ships them to London and Paris, and then demands such high prices that often a whole year must be consumed in dickering before a bargain can finally be reached. Taken together, all these reasons explain why pearls have advanced so rapidly in price, and also why fine large pearls have increased most rapidly in value. It would also appear from this, that since the supply is so inadequate to the demand, pearls, and especially fine ones, must inevitably advance greatly in the future.

Pearl Syndicate

In conclusion Mr. Nissen says that "the coming into the market of a really fine twenty to twenty-five grain pearl is almost as much

a sensation in the pearl market as the discovery of an unknown Rembrandt picture."

Skin of Pearls

The skin of an oriental pearl is formed like that of an onion, and very highly skilled workmen can sometimes remove the outer layer of a pearl with a bad skin and thus produce a smaller pearl of good skin. This is very seldom done in America, however, and at best it is always a gamble whether the risk should be incurred. Fresh water pearls, on the other hand, are not formed in layers, but in sections, and cannot be peeled.

Pearls vary greatly in color and shade. Those of pure white or white with a rose pink tint, with good luster, are the most valuable of the regular colors. Creamy white is also desirable. Of the fancy colors black pearls of fine skin and shape are very valuable, as are also fine pink pearls. *Button* pearls are those with one side flat, while *baroque* pearls are always of odd and irregular shapes.

Colors of Pearls

Pearls may be injured by acids or by being scratched, but are not harmed by pure water. A string of fine pearls should always be carefully wiped and put away in soft cotton after being worn. They should be restrung quite often.

As is well known, gems and particularly pearls, have from remote antiquity been re-

garded as of great value and have, therefore, been eagerly collected by kings and princes. Many pretty legends have arisen from this fact, especially among the rajahs of the East. An interesting example of this spontaneous and interesting literature of gems has been handed to me by Mr. Nissen, and is as follows:

The Origin of the Superstition that Pearls Bring Tears

Pearl Legend

The Princess of Travancore, who was stolen by a Rover of Kandy and lost in the storm called down upon his ships by a potent Brahman, is the heroine of the tale. Her body was recovered and with it came a great gift, as the legend thus relates.

Now, when the elements were at peace again, the King gave orders that certain fishermen of his people who were expert divers should explore the bottom of the sea where the ships of the Rover were destroyed. One of these discovered the body of the Princess and brought it to shore. And when they prepared it for burial the women found fastened upon one of the hands a shellfish, the two shells of which had closed upon a finger when it fell between them as they gaped. And when the shells were pried apart there rolled from between them a round bone, white and shining, and yet of a luster so soft and beautiful

that no man had seen the like. And the Brahman, when he saw it, said: "Herein are the tears of Heaven which fell into the sea, congealed and have become a gem which is beyond price." And he named it "Pearl," and carried it to the King. Then the King, after he had heard the story of it, sent for the chief man of them that worked in gold and commanded him that he make for the pearl a setting most precious, and when it was done, he gave it to the Prince, his son, saying: "Above all things let this be first among the jewels of Travancore forever." And the Prince, when he looked upon it said, "The beauty of it is like the brightness of her eyes when they veiled themselves before my passion," and he prized it more than all the diamonds and rubies in his treasure house.

The Tariff on Diamonds, Pearls, and Precious Stones

The recent Underwood Tariff which caused so many changes also brought into prominence new aspects of the diamond and gem importing business. For many years the tariff on polished diamonds and on other finished gems, including pearls, had been ten per cent. By the new tariff this was raised to twenty per cent, and rough diamonds, which heretofore had been on the free list, were made to bear a duty of ten per cent.

The gem importers made a concerted effort to prevent the change in tariff, because they believed that the object of the Administration would be defeated rather than furthered by the changes. In other words, they believed that the government would secure less revenue rather than more, because of the added inducement to smugglers. However, the tariff was raised and the only recourse now open to legitimate dealers is to see, so far as possible, that no smuggling is done. The American Jewelers' Protective

Association was formed to accomplish this purpose. In the association are incorporated almost all the legitimate dealers and importers in gems and precious stones in the country. These concerns realize the danger of competition with gems smuggled into the country, and through the association they endeavor to aid the federal government by furnishing the customs authorities with information which they alone, for obvious reasons, are in a position to obtain. For this purpose the association employs detectives in Europe, whose work it is to know what important purchases are made and how they reach America. By these means smugglers have recently been detected and caught, who used the most ingenuous means for concealing the goods.

The work of the association is further aided by a clause in the Administrative Act of the new tariff, which provides that, "where a seizure has been made, the burden of proof shall be upon the claimant." Under this provision even regular buyers of precious stones must be prepared to furnish evidence that the stones were legitimately brought into the country, since, if a smuggler is detected, not only will his goods be seized, but also the smuggled stones that he may have sold to his

customers. Dealers must, therefore, be on their guard to purchase stones only from reputable, responsible houses.

In the matter of the relative advantages to individuals in purchasing diamond jewelry abroad and at home, Mr. Ludwig Nissen, president of the American Jewelers' Protective Association, contributes some illuminating information. He says, in the first place, that he has never known a person to make as good purchases abroad as could have been made at home. Methods of doing business in these goods are entirely different on different sides of the Atlantic, and the customer not versed in the technicalities that enter into the valuation of jewels, must often fall more or less a prey to the merchant working under a different code of commercial honesty than exists here. Also it must be noted that the quality of precious stones sold in Europe is very often not that desired by Americans.

Precious and Semiprecious Stones

Rubies, emeralds, and sapphires are always classed as precious stones. Many other gems should be termed "precious stones" because of their rarity and beauty. Especially should they be termed so in times when they are much in vogue, and because of this demand through fashion have advanced very largely in price.

The question may be summed up by saying that in addition to diamonds, rubies, sapphires, and emeralds, very fine specimens of many of the so-called semiprecious stones should be considered precious stones, perhaps at all times, and unquestionably so at times when there exists a fashionable demand for them and they have in consequence attained great value.

The Ruby

Composition Rubies and Sapphires are scientifically the same stone, differing only in color. Corundum, the predominating mineral of both, is composed of nearly pure alumina. The coloring substance which differentiates rubies and sapphires is believed to be *chromium*. In the scale of hardness the gem ranks as No. 9 and is thus the hardest of all substances excepting the diamond. Color is the most important factor in determining the value of the ruby. The gem is always more or less imperfect, but its freedom from bad imperfections is also important. Since fine rubies of all sizes are extremely rare, the price increases very rapidly with an increase in size, and a fine ruby of more *Value* than four carats commands an extraordinary price and can be said to be the most valuable of all gems, exceeding greatly a diamond of equal weight. A ruby of eleven carats is reported, some twelve years ago, to have been sold for $80,000, but this is almost the limit of size in which rubies *Color* are ever found. The color varies from the lightest

NATIVE INDIAN RUBY CUTTER AT WORK

rose tint to the deepest carmine, but the rarest and most valuable shade is that known as *Pigeon Blood*. This is the color of arterial blood. The ruby has always been greatly admired, and Ruskin calls the ruby in the British Crown the most beautiful gem he has ever seen.

The finest rubies come from Burmah and are termed Oriental Rubies. Siam also produces rubies, but of a much darker red and of very much less value. Rubies are also found in Ceylon, India, Australia, Brazil, and occasionally in America.

Cutting

Rubies, as well as sapphires, are sometimes cut in India in *cabochon* form and are afterwards recut in Europe. The style is often cushion shape, with step cutting. They are also cut round and pear shape, similar to the cutting of a diamond of these shapes. The stones are cut thick or shallow to deepen or diminish the color of the stone.

Synthetic Rubies

Many years ago scientists succeeded in producing minute crystals of rubies and sapphires which could not be distinguished from the rubies of nature even by the microscope. These specimens were, however, very small and of no commercial value. These minute crystals are the only truly *synthetic* rubies which have ever been made.

The *scientific* ruby now on the market is

simply a chemical product made by fusing powdered alumina, colored to imitate the gem by the addition of a metallic oxide. This scientific ruby, because it is better and cheaper, has largely taken the place of the *reconstructed* ruby, made by melting small fragments of real rubies. These chemical products when dyed blue pass in a similar way for sapphires.

How fine Imitation Rubies are Detected

All these imitations of the true corundum gems can be detected by an expert, most of them at first sight and without hesitation. And even in the much rarer cases when the imitation approaches the real stone very closely, the former can always be detected under a microscope. In the real, fine parallel lines of structural strain are seen and the little enclosures, or bubbles, are irregular in shape, whereas in the imitation the lines of strain are curved and the bubbles round.

While scientific rubies and sapphires have a distinct use as ornaments, they can never affect the sale of the real gems any more than is the case with imitation pearls. Aside from the fact that the imitation can always be ultimately detected, the person desiring to purchase a ruby, AS A RUBY, and as a work of beauty and distinction wants a gem which he knows is one of nature's rarities and is therefore possessed

of intrinsically great value. A good illustration of this fundamental feeling is given by Mr. Zell, who says, "Many perfect copies of the Sistine Madonna have been made by good artists, the original is priceless, the copies at the most are worth a few hundred dollars, — this is the relation of a gem made in nature's laboratory to one produced by the chemist."

The Sapphire

The Sapphire is the other great branch of the *Corundum* family of gems. It differs from the ruby only in color.

Color

Sapphires vary in tint from the lightest blue to a deep blackish blue, and, similar to rubies, are valued chiefly according to their color. The soft, velvety blue most approaching the blue of the *cornflower* of England, which is known in our country as the bachelor's button, is the most valued color in sapphires. The best stones should show this color by artificial as well as by natural light.

Value of Large Size Stones

Although choice sapphires are uncommon, fine large stones are more frequently found than rubies of similar size, and consequently the price does not advance with an increase in size so rapidly as it does with rubies.

Sapphires are found in various places, each locality producing its distinctive shade.

Where finest Sapphires are Found

The finest specimens are termed *Cashmere* sapphires, and occur in the Himalaya Mountains of the State of Kashmir in India. These

GEM CUTTING IN CEYLON

gems possess a velvety luster, and a vivid color of the true *cornflower shade*, without the slightest trace of green or black.

Another important locality for sapphires is Burmah. These Burmah or *oriental* sapphires have a much darker shade of blue. While they bear the name Burmah, most of the stones come from the adjacent country of Siam. The most important mine is the Bo Pie Rim mine, in Battambang.

Ceylon produces sapphires of very light shades, ranging from delicate pale gray blue to purplish blue.

The sapphires found in Australia are generally poor in color, and although fine gems occur they are exceedingly rare.

Montana Sapphires

In our own country fine sapphires have been found in Yogo Gulch, Montana. These stones have a fine electric blue tint, and the larger sizes which are occasionally found are very valuable, approaching in price the oriental.

Most of the *Montana sapphires* which are found near Helena are small, — one carat and less, — but are of a very uniform color and are especially suited to be cut into round stones. The Montana sapphires have been known since 1865, but the mines were first systematically worked in 1891. Since that time they have

always been by far the most valuable gem-mineral resource of the United States.

Star Sapphire Cutting and Formation

An exceedingly beautiful and interesting variation in gems is the *star sapphire* and *star ruby*. These are very valuable when the star marking is well defined and shows a fine, six-pointed star, which is always more clearly defined when seen under an artificial light. Star sapphires and rubies are always cut cabochon, with the center of the star at the apex of the cabochon. What causes the formation of the star is not definitely known, but it is probably due to the presence of a foreign substance in the sapphire or ruby.

Sapphires in History

In history both these gems are of great interest. Rubies are mentioned in the Bible in the Proverbs and in the Book of Job. The Greeks and Romans ascribe to the ruby the power of emitting light in darkness; the Hindus describe the abodes of their gods as being lighted with rubies.

Sapphires were also known in ancient times, which is attested by the fact that the word sapphire is nearly the same in all languages.

The gem was believed to be a destroyer of poison and a powerful charm, protecting the wearer from fever.

Dr. O. C. Farrington states that "Burton, the

African traveler, is said always to have carried a star sapphire about with him as a means of gaining respect from the barbarous peoples among whom he journeyed. The savages believed that the stone must be a talisman of great power and feared to incur the owner's enmity."

The Emerald

Composition and Hardness of Emeralds

Beryl is a mineral known to gem lovers under several different names, the most valued of which is the *Emerald*. The mineral beryl composing the various gems is practically the same in composition, hardness, and other properties, and the gems may be differentiated only by their color. In composition beryl is a silicate of aluminum and glucinum. On the scale of hardness beryl is graded 7½ to 8, and is thus much softer than the diamond, ruby, or sapphire. It is owing to this fact that the emerald scratches easily and that care must be taken that when worn it is not subject to chafing by diamonds or other harder gems.

Color and Perfection

Beryl as a mineral is of quite common occurrence, and the crystals of the mineral in its cruder form often grow to enormous size. There is one such single crystal preserved in the Boston Museum of Natural History, which is three and one half feet long and three feet wide and weighs several tons.

Beryl in this common form occurs in many

localities, but the mineral in its rarer form of emerald is comparatively of very rare occurrence. The emerald or green beryl, as it should be scientifically known, has long been the most highly prized of the green gems. In brilliancy it exceeds all other green gems excepting only the very rare green sapphire. The most valuable specimens exhibit a vivid *grass-green* shade, and it is to this color that they owe their great value. Other considerations, such as freedom from imperfections, are quite secondary in determining the value of the stone. In fact a perfect emerald is almost never found, and this circumstance has passed into an Eastern simile which runs, "As scarce as a perfect emerald," this being a symbol for the acme of rarity. The emerald is light in weight and an emerald of a given size will be about a third larger than a diamond and forty-five per cent larger than a sapphire of equal weight. The distinctive color of the emerald is probably due to a trace of *chromium* in its composition.

Weight

The largest source of supply of fine emeralds is a mine in Muso, a locality about seventy-five miles northwest of Bogota, in the United States of Colombia. This mine has been worked almost continuously since 1558, but the wildness of the region and the barbarity of the aborigines

Where most good Emeralds are Found

has made the working of the mine, at least until recently, quite precarious.

Form of Cutting

Fine emeralds are generally cut cushion shape with step cutting, and in the East are often cut *cabochon*. Fine emeralds have advanced very rapidly during the last few years, both on account of the growing demand of fashion for the gems and the scarcity of really fine specimens.

Many interesting stories are told of the first emeralds taken by the early conquerors of Peru to Spain, and a certain Joseph D'Acosta is said to have returned to Spain in 1587 with two chests of emeralds, each of which weighed over one hundred pounds. The truth of this story may be questioned, but it is a fact that the stones were highly prized and much used by the Incas and Aztecs in the extraordinary civilization which once existed in Peru. The emerald was highly prized by the ancients and by gem lovers of the middle ages, and this accounts for many interesting legends and superstitions relating to the gem.

The Aquamarine

Aquamarine is another of the gems composed of *Beryl*. It occurs in colors of light sky blue, greenish blue, or greenish yellow. The light sky-blue stone is the one of the most value, and is very brilliant, especially by artificial light. Recently aquamarines have become more and more popular, and this is doubtless due to the discovery of many fine masses of the crystal. Some of the finest of these are in Siberia, India, Brazil, and in many different localities in the United States, notably in North Carolina. The color of the aquamarine may be altered by various artificial means, and experiments along this line have been undertaken for many years by some of the German universities, resulting in the discovery of a method by which in rare cases the less valuable greenish-blue variety may be changed to a shade of light sky blue of great value without altering the stone to any perceptible degree. Because of this, it is thought that the coloring matter in the gem must be organic.

Colors

Where Found

Biblical Mention

The history of the aquamarine is not as complete as that of the more valued stones. A notable biblical mention of the stone is, however, found in the Song of Solomon,

"O daughters of Jerusalem,
This is my beloved, and this is my friend.
His hands are as gold rings set with the beryl."

In the middle ages, beryl was supposed to give its wearer cheerfulness and to compose the heart and mind. It was called, in fact, the "sweet-tempered stone," and these qualities might perhaps account for the presence of a piece of blue beryl in the English crown.

AQUAMARINE MINE, MITCHELL COUNTY, NORTH CAROLINA

The Tourmaline

Brilliancy

Tourmaline is like beryl, a mineral which is in itself of great interest, especially to scientists, and one which in smaller crystals sometimes attains such beauty of coloring and brilliancy as to become of rare charm as a gem.

Its Composition

Tourmaline has always puzzled scientific authorities in determining its composition, and in lack of a concise or authoritative definition of the chemicals composing it, we will quote the following description of its composition given by Ruskin, in his "Ethics of the Dust": "A little of everything, there's always flint and clay and magnesia in it; and the black is iron according to its fancy; and there's boracic acid, if you know what that is, and if you don't, I cannot tell you today, and it doesn't signify, and there's potash and soda; and on the whole, the chemistry of it is more like a medieval doctor's prescription than the making of a respectable mineral."

As we noted at first, tourmaline as a mineral is quite distinct from its rarer gem species.

Its Colors

As a mineral it occurs in an opaque form, colored either black or brown, and is quite common as a rock-forming mineral, resembling somewhat in its occurrence in this form, *hornblend*. These crystals often possess strange and beautiful qualities, notably that of having a strong *dichroism*, that is, the same crystals often have different colors, being at one end red and at the other end green; or, on the other hand, the crystal may show a blue center, then a colorless zone, and then one red and one green, and furthermore the crystal will always show two different colors according as it is viewed from one angle or another. The beauty of these changing colors is often very striking, and is the chief cause which has led the tourmaline to be widely appreciated as a gem.

In the cutting of the gem skill is necessary in order to so cut the specimen that it will exhibit its most beautiful color. The most valued colors are, as a rule, dark red, sometimes almost approaching that of the ruby, and dark green shading to blue or yellow.

Tourmaline Mines

One of the chief localities for the mining of the gem tourmaline is Paris, Maine. The discovery of this source was mainly accidental. Two boys of the neighborhood, Elisha L. Hamlin and Ezekiel Holmes, had for some time been

TOURMALINE MINE, PALO, CALIFORNIA

interested in the study of the minerals which were of frequent occurrence in the fields about their homes. One day in the fall of 1820, after hunting some time for specimens, they were attracted by the gleam of something green at the roots of a tree. They eagerly secured the mineral, and found it to be a beautiful green tourmaline. However, it was late in the day and their explorations could not go further. Then chance further delayed the discovery of more of the beautiful crystals, for that night it snowed heavily, and no further work could be done in the frozen ground until the following spring. But with the first thaw the boys worked with great interest, and soon secured many fine gems. Since that time the locality has been extensively worked, and some of the gems taken from it have found places in the crowns of kings. Ten years ago it was estimated that $50,000 worth of tourmalines had been taken from this one spot.

Other localities for mining tourmalines are California, which furnishes in particular the red tourmaline, Brazil, Siberia, and Ceylon.

Since tourmalines are of relatively recent discovery there are no historical associations coupled with them, and no legends are related of them, although the story of their strange discovery and the beauty of the gem would seem to deserve this.

The Alexandrite

Discovery This gem was first found in Takovaya, in the Ural Mountains of Siberia, in 1830, on the anniversary of the birth of Alexander II, Czar of Russia, and because of that circumstance and since green and red — the colors of the gem — are also Russia's national colors, it was named, in honor of the Czar, *Alexandrite*.

Hardness and Color The mineral composing the gem is *Chrysoberyl*, which resembles beryl in composition but is remarkable for its hardness, being graded 8.5. The alexandrite shows ordinarily an emerald-green color, but changes by artificial light to a beautiful red, and has, therefore, the unique property of resembling somewhat "an emerald by day and a ruby by night." Much of the mineral is found, but transparent pieces which can be used as gems are of very rare occurrence, and Alexandrites are therefore very valuable, besides being unique in the beauty of their double colors.

Cat's-eye A more common variety of chrysoberyl is the gem known as *Cat's-eye*, which always shows

the familiar band of color in the center. Most of the stones are cut cabochon, in order to best display this property. Most of the cat's-eyes now come from Brazil and Ceylon.

The Opal

"The opal, when pure and uncut in its native rock, presents the most lovely colors seen in the world, except those of clouds," says Ruskin, in his lecture on "Color." The mineral composing the opal does not, however, always show the brilliancy of colors which we usually associate with the gem. Chemically, it is an oxide of silica, and is therefore much similar to quartz. As a mineral, opal is quite common, and one of its interesting occurrences is in the Yellowstone Park, where the geyser and hot spring formations are composed almost entirely of this silicate known here as *geyserite*. It may be said, therefore, that the waters of the park build up cones of opal and fall into opal basins. In the rarer form in which it displays its many fascinating colors the gem is of comparatively rare occurrence. The most noted and most ancient mines are those of Czernowitza, in northern Hungary. It is well established that the Romans obtained their opals from these mines. At the present day, however, this ancient source has become

Composition

superseded by the more abundant mines in New South Wales.

Why the opal displays so many brilliant colors has been somewhat of a riddle to scientists. The most probable theory of the varied coloring is that it is formed by strata in the stone, containing different percentages of water which break up the ray of light similarly as a prism does. The most beautiful and fascinating opals are the dark ones, known as *black opals*. These come from Australia, and since they are in great demand today, command large prices.

Superstitions

In history the opal has always been famous and was very highly prized by the Romans. In contradiction to the superstitions that are now associated with the gem by some people the opal was then regarded as having the virtues of all the stones whose colors it displayed. It was supposed to cheer the despondent and was in general a symbol of hope. And like the turquoise, it was believed to change color if its wearer grew ill and regain it when he recovered.

The Amethyst

Color, etc.

The common mineral *quartz* in one of its rarer forms is known to us as amethyst. It is the only gem which displays a beautiful violet color. This color is thought to be caused by organic matter within the crystal, and this theory is supported by the fact that the amethyst when heated first changes to yellow and then entirely loses its color.

Where Found

The chief sources of supply of amethysts are now located in Siberia and Brazil, although a very few stones have occasionally been found in the State of Maine. The finest stones must have a rich, dark violet color, while the lighter shades are of much less value. In former times the amethyst was much more highly valued than at present, owing, no doubt, to the relative scarcity of the gem at that time. But it must ever continue to be highly prized for the intrinsic beauty of its violet color.

The amethyst has with many other gems a long history. Its name is derived from two Greek words, meaning "not to inebriate,"

indicating that it was the belief of the ancients that anything drunk from cups of this mineral could never produce any deleterious effect. During the middle ages it long figured as a pious or episcopal gem and was long sacred to the Church.

The Moonstone

The moonstone is a form of felspar, and comes chiefly from Ceylon. There it occurs in large pieces in clay. When properly polished the gem exhibits a beautiful pale-blue light coming from within. The cause of this light is hard to explain, but is thought to be a reflection from minute tabular crystals arranged in parallel position in the stone. Moonstone, like most of the more or less opaque gems, is usually cut cabochon form. The stone is now becoming more and more popular.

The Turquoise

This mineral is remarkable among all the gem minerals in not being transparent and in never occurring in the form of a fine crystal. In composition turquoise is a hydrus phosphate of aluminum. The gem is rather soft; its grade is No. 6.

Sources of Supply

The ancient supply of fine turquoise came from a mine not far from Nishapur, in Persia, and the mining of the gems in that locality is said to have supported the entire population of the town. The mines must be very ancient. A description of one was written in the year 1300 A.D. and according to a popular tradition, one of the mines, known as Isaac's Mine, was opened by Isaac, son of Abraham. At the present time most of the turquoise come from New Mexico. These mines also are very old and were first worked by the Spaniards, it is said, by consent of the Indians, who still inhabited the land.

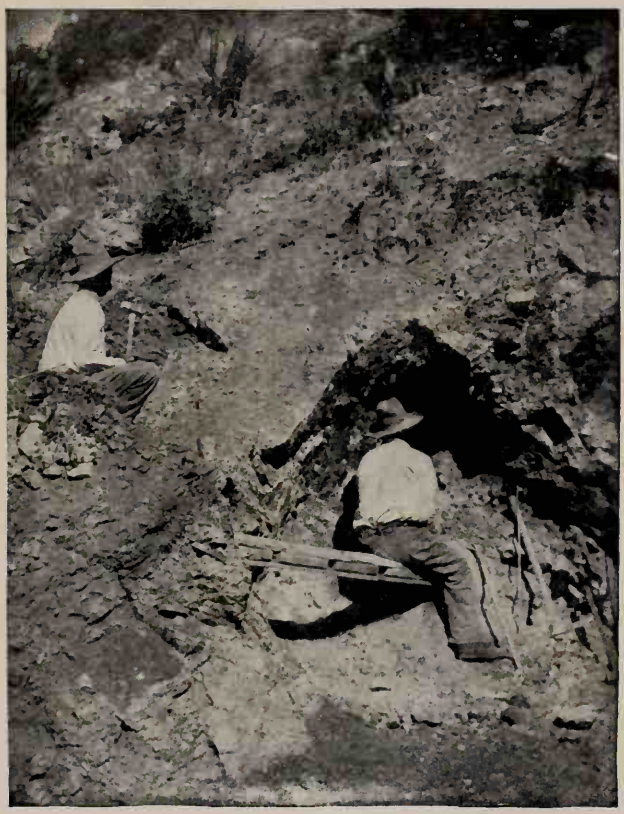
Color

The predominating color of the turquoise is green, while on the other hand the color of

most value is blue, and most turquoise are not free from the imperfection of turning green by exposure during the course of time.

Turquoise are sometimes artificially stained, but this can be easily detected, and is of little interest to the real admirer of this interesting gem.

Owing to their early discovery the turquoise has always been prized by Eastern people, and amongst oriental people is still considered of great value. Superstition, as usual, mingles in this estimate of value, and it is stated by good authority that turquoise are still used in the East as a remedy for dyspepsia and insanity. It has also been supposed since earliest times to bring its wearer good fortune, and one of the proverbs of the Oriental is, "A turquoise given by a loving hand carries with it happiness and good fortune."



SCENE IN AZURE TURQUOISE MINE, NEW MEXICO

The Chrysolite

Peridot and Olivine

Chrysolite as a name for gems is unique, in that it seems to have been used for several gems in ancient biblical times, but now appears to have disappeared and given place to several other names for the mineral, of which *Peridot* is used for designating the deep olive-green variety, *Olivine* when the mineral is yellowish green, and *Chrysolite* only when the gem is of a lighter or golden-yellow color. The name chrysolite means "gold stone." Aside from the beauty of the colors afforded by the three gems, Peridot, Olivine, and Chrysolite, the origin of the mineral is perhaps its most interesting property. Although many of the gems are now known, it is very hard to determine exactly where they have been found. They are reported to come from Burmah, Ceylon, Egypt, and from Brazil, but it is impossible to ascertain the exact locality. Because of this obscurity, Kunz states that nearly all the chrysolite used in modern times has been taken out of old jewelry, and it is, therefore, probable

that the old localities are either forgotten or exhausted. There is, however, one very striking source for the gem. The mineral is known to be an essential constituent of meteorites, and crystals are often found in these masses large enough to be of value as gems. It is thus an interesting fact that chrysolite is the only gem which comes to us from spaces of which we know nothing, actually beyond the earth.

Mention in the Bible

Chrysolite has, as I have stated, long been known, and is frequently mentioned in the Bible and in ancient literature, but much of the mineral then known as chrysolite was in reality topaz. An interesting fable of its discovery in those early times is related. Diodones Siculus says of the stone, "That it was not discernible by day, but was bright at night, so it could be seen by the patrol. The latter would cover the luminous spot with a vase, and the next day come and cut out the rock at the place indicated. After being polished a beautiful chrysolite would appear."

The Spinel

Composition and Hardness

Spinel is a mineral somewhat similar to ruby, but as spinel gems are quite different from true rubies, so the mineral spinel is quite distinct from the mineral of the true ruby, which is *corundum*. In composition spinel is almost wholly a magnesia aluminate, and in hardness is much softer than the ruby, being No. 8, or no harder than the topaz, while the ruby is No. 9.

Black Prince Ruby

Spinel occurs in various colors, but the most valuable color is red, called the *spinel ruby*. From the fact that the spinel so closely approaches the ruby in appearance, it has often been confounded with it, and in cases of fraud spinel is sometimes sold in place of the corundum ruby. In its own sphere, however, the spinel is a beautiful gem, and while never found in very large sizes, has yet been so highly prized that it is found amongst the crown jewels of several nations. The ruby of the "Black Prince," which is shown among the crown jewels of England, is a notable example of spinel.

Where Found

As spinel is related to corundum in composition and appearance so it is also often found associated with it in nature. The gem gravels of Ceylon, Siam, Australia, and Brazil contain spinel rubies, and the true corundum rubies side by side, but the commercial source of spinel rubies is now almost entirely a locality called Badakschan, in Afghanistan, on the banks of the Oxus. According to a Persian tradition these mines were first disclosed when the mountain was rent in twain by an earthquake.

Its Colors

Besides the ruby spinel the mineral occurs in several other colors, which may be used as gems, viz.: red, orange, green, blue, indigo, and also black and white. Colorless spinels are occasionally passed in cases of fraud as diamonds, but the deceit may be readily detected.

While the mineral spinel may be used as a gem in all the colors in which it occurs, the only shades which are abundant enough to deserve special notice, aside from the red, are the blue and black. Blue spinel resembles the sapphire in color, although it is somewhat paler. It comes chiefly from Ceylon and Burmah, where it is found with the ruby spinel. The black spinel is known as *Ceylonite* and comes also from Ceylon.

In ancient times spinel rubies and corundum

rubies were equally well known, and the two were probably often confounded. Dr. O. C. Farrington, in his delightful book, relates as usual some interesting superstitions regarding the spinel. In the middle ages, for instance, it was believed that, "if one touched with this gem the four corners of a house, orchard, or vineyard, they would be protected from lightning, storms, and the like." *Legend*

The Topaz

Topaz is a mineral which has been known and prized since biblical times for its remarkable clearness and transparency. Its decline in popularity some time ago was due mainly to the fact that many far inferior stones were wrongly termed topaz. The real topaz is now, however, being more and more appreciated.

Composition and Hardness

The real topaz is a silicate of aluminum and is remarkably heavy, and is also quite hard, being No. 8. The usual color of the gem is yellow, but topaz are also found in many other shades. As is the case with aquamarine, the color may often be altered by artificial means. The yellow topaz of Brazil may, for example, be changed to a pale rose pink by heating, and this is often done. The heating and cooling of the gem must be done very carefully and slowly, but the operation presents no difficulty to an expert, and the pink color when once secured is absolutely permanent. Crystals of the topaz mineral often grow to large size, and occasionally specimens of sufficient clearness to be used as

gems are found of remarkable size. Perhaps the largest cut topaz is the one presented to Pope Leo, in 1902, which weighed nearly four pounds.

Where Found

The most abundant source of the gem is an island called Topazios, in the Red Sea, and from this word is formed the present name of the gem. In modern times the largest supply of topaz has come from Brazil. It is here usually found in pebbles amongst the gravel of streams. Ordinarily occurring as a matrix in talcose rock of mica slate, the action of the stream has worn away the softer matrix, and thus disclosed the topaz in a round and worn form, but entirely free from the matrix, and known in the region as *pingos d'aqua*, meaning *drops of water*. They are also called by the Portuguese "*slave's diamonds*," and occasionally a fine example will approximate in appearance a diamond; in fact, a stone in the crown of Portugal reputed to be a diamond of 1680 carats weight, and called the Breganza, is probably a topaz of exceptional clearness and beauty.

Another noted locality for topaz are the Imperial mines of Russia, in the Ural Mountains. Superb topaz are cut from the crystals found there, but the finest examples are now preserved for the Imperial collection. Many localities in the United States also afford topaz.

Mention in the Bible In biblical times topaz was a very highly prized gem, and in Revelations is mentioned as forming one of the gates of the Holy City. It is also related that the King of Tyre wore a topaz. However, the gems spoken of under this name were probably chrysolite, while what the ancients termed chrysolite would now be known as topaz.

Legend A charming legend is told of a topaz supposed to be presented by Lady Hildegarde, wife of Theodoric of Holland, to a monastery in her native town. It is said to have emitted at night a light so brilliant that prayers could be read in the chapel, where it was kept, without the aid of a light.

The Garnet

Names of Garnet

Garnet is a gem mineral which varies greatly in composition, and in its various forms is known under the different names of *almandite* or *almandine*, *pyrope*, *rhodolite*, *cape ruby*, and *carbuncle*. The color is usually a dark red, but the mineral also occurs in green, rose, and brown tints. The mineral is a silicate, and the other components of its composition determine which particular variety of garnet it is. Garnets often occur as small grains in beach sand because the rocks in which the minerals occur are more easily weathered away than the garnet which thus remains in the form of sand. The garnet crystals are then always found near the water's edge, since the specific gravity of the mineral is high and the waves can, therefore, carry it only a short distance up the beach. The name garnet comes probably from the Latin word *granatus*, meaning *like a grain*. It is said to have arisen because the crystals were thought to resemble in color and size the seeds of the pomegranate.

The garnet most valued as a gem is termed *almandite*, and is of a rich cherry, claret, or blood-red color. These stones were first mined near the city of Alabanda, in Asia Minor, and the same source was much exploited by the Romans in their day. The stones are still known as *Syrian garnets*. This same mineral occurs in large quantities near the mouth of the Stickeen River, Alaska, but is not of sufficient transparency to be greatly used as a gem.

Another variety, and probably the most numerous one of the garnet mineral, is known as *pyrope*. It does not vary much in color from *almandite*. The mineral is almost always found in eruptive or volcanic rocks, and is a constituent of the diamond-bearing blueground of South Africa. From this fact the finer specimens of the gem are termed in the trade *cape rubies*.

The home of the pyrope is, however, Bohemia. Although the stones were known in this region for centuries it was not until after Karlsbad had become an international center that interest was taken in the scientific mining and polishing of the gems. Since then the fame of these garnets and their usefulness in the arts when not of sufficient fineness for jewels has led to a thorough exploitation of the field, and Bohemia

may be considered to have been for many years the garnet center of the world. As has been said, these garnets should technically be called pyrope, which is derived from the Greek word meaning "fire," a name given them in ancient times because of their brilliant color.

American Rubies

In America some fine garnets have been found. These are termed, however, *rhodolite*, or *American rubies*, and are really much like almandite. They occur most abundantly in Arizona, New Mexico, and southern Colorado. They are especially abundant among anthills, being removed by the ants because their size stands in the way of the excavations of the busy insects. They are gathered largely by the Navajo Indians and are sold to American gem dealers. In color and brilliancy they often surpass the African gems known as *cape rubies*.

Carbuncle

The word *carbuncle* is often popularly used to designate a garnet. This, however, is a misnomer. Ordinarily any fine red stone cut *en cabochon* might be termed a carbuncle. This latter name came from the Roman word *carbunculus*, which in turn is a derivation of the Latin word *carbo*, meaning coal, and was at that time bestowed on any stone displaying the fire-like color and reflection which is characteristic of the various stones now termed

garnets. As all these stones in ancient times were cut in the round shape, the name has come down to us as carbuncle, and its association with the garnet has always been preserved. However, scientifically carbuncle refers merely to the shape of the stone, and not at all to its composition or mineralogical variety.

One of Oldest Semiprecious Stones Known

The garnet is one of the oldest stones known. In some of the most ancient mummies discovered in Egypt are found necklaces and other jewels containing garnets. And under the name carbuncle the garnet is mentioned in the literature of all ages, being valued chiefly for the brilliant fiery light which it gives forth. According to the Talmud, the only light which Noah had in the Ark was afforded by a carbuncle.

The Zircon

Its Color

Zircon is a mineral possessing a very hard, brilliant luster, and is therefore eminently qualified to be used as a gem. The mineral occurs in various colors. Tints of brown, violet, and green are known as *Zircon*, the red as *Hyacinth*, the yellow *Jacinth*, and the grayish white and white, *Jargoon*. The latter name is said to have been given the white substance because through its great luster it resembled the diamond, but is really of much less value.

Where Found

Transparent crystals of zircon suitable for gems come almost wholly from the Island of Ceylon, where they occur in the gem gravels which also contain rubies, sapphires, tourmalines, etc. The zircons occur in the form of rolled pebbles mostly of comparatively small size.

Zircon is also found in many other localities. It is said as many as one hundred and twenty different places are known where the mineral can be found, but in all of these the supply is very limited.

The Zircon has no history, but its great brilliancy and fine colors render it a most attractive if but little known gem.

Lapis Lazuli

An Ancient Gem

The gems known as lapis lazuli are only the finest specimens of the comparatively abundant mineral of the same name. This stone was a gem of the Greek, Roman, and Hebrew scriptures, and throughout ancient times was very highly prized. Pliny likens it to the blue sky adorned with stars. Large quantities of it worked by artisans into various forms are found in early Egyptian tombs. The Chinese have also long held it in high esteem.

The Asiatic mines from which the mineral first came were visited by Marco Polo, in the year 1271 A.D.

The color of the mineral is blue. It is quite opaque. The most prized shade is ultramarine, but the stone occurs also in paler tints. Usually grains of pyrite are scattered through the stones and from this effect Pliny was able to liken it to a "starry sky." The name lapis lazuli means *blue stone*.

Where Found

The best lapis lazuli now comes from Badakschan, in the northeastern part of Afghanistan.

The mining is done in the most primitive form. Huge fires are built on the rocks, and water is then thrown on them. Owing to the sudden cooling the rocks split up and can then readily be excavated. The yield, however, is small, and the price even for exceptionally fine specimens is low. China and other parts of Asia consume most of the supply.

The color of the stone, however, gives it a peculiar charm, and the walls of the Palace Zarskoe-Selo, Russia, built by the order of Catherine II, were entirely lined with slabs of lapis lazuli and amber. The stone was believed by the Greeks and Romans to have strong medicinal properties, and when pulverized was often used as a tonic. Even as late as the sixteenth century it was supposed to be a cure for melancholia.

Hiddenite and Kunzite

Where Found

Spodumene is the mineral composing two comparatively new and charming gems, *Hiddenite* and *Kunzite*. Ordinarily spodumene is of a white or gray color, and possesses no great value as a gem, but in its rarer form as hiddenite it possesses a beautiful emerald-green color. The only deposit of hiddenite known was found accidentally by Mr. W. E. Hidden, through the overturning of a tree on a farm near Stony Point, Alexander County, North Carolina. The mineral is somewhat hard to polish, owing to the danger of splitting, due to its marked prismatic cleavage. Although the stone possesses beautiful qualities as a gem and commands a high price it is unfortunately little known, as the mine at Stony Point, North Carolina, was reported to have been exhausted some ten years ago and no fresh supply of hiddenite has ever been discovered.

Kunzite Where Found

Kunzite is one of the newest gem minerals known. It was discovered during the course of some mining for tourmaline, near Pala, San

Diego County, California, and was named in honor of Dr. Kunz, who was for many years the special agent of the United States Government, and compiled the official document concerning gems, appearing annually, together with other reports, under the name of the "Mineral Resources of the United States."

Color

Kunzite is dichroic, and possesses a charming and almost indescribable light-blue color, which has been characterized as *deep rose lilac* and *delicate pink amethystine*. The same crystal displays two different tints when viewed at different angles.

The mineral is now highly prized as a gem, and its beautiful and delicate color make it entirely unique. Unfortunately the supply is very limited. The purely chance discovery of such a new and beautiful gem forms what might almost be regarded as a romance. Think of the chance conjunction in nature of the peculiar chemical properties forming the mineral, then the centuries of the infinitesimal growth of the crystals from these solutions, and finally when the whole had reached its last stage of perfection, its chance discovery through the prick of the miner's pickaxe.

TABLE OF PRECIOUS AND SEMIPRECIOUS STONES

Name of Gem	Chemical Composition	Hardness	Color	Principal Localities	Occurrence
DIAMOND	Carbon 100	10	Colorless, Yellow, Red, Blue, Brown, Pink, Green, and Black	India Brazil S. Africa Australia	In Quartzose Conglomerate
RUBY	Alumina . . . . . 98.5 Oxide of Iron . . . . 1.0 Lime 5	8.5 to 9	All shades of Red	Burma Siam Ceylon	Frequently in river gravels
SAPPHIRE	Alumina . . . . . 98.5 Oxide of Iron . . . . 1.0 Lime 5	9	All shades of Blue	Burma Siam Ceylon Kashmir	Frequently in river gravels
EMERALD	Silica . . . . . 68. Alumina . . . . . 18.3 Glucina . . . . . 12.2 Magnesia . . . . . .8 Soda 7	7.5 to 8	"Emerald" Green	Montana Australia India S. America Siberia	In limestone
AQUAMARINE	Silica . . . . . 68. Alumina . . . . . 18.3 Glucina . . . . . 12.2 Magnesia . . . . . .8 Soda 7	7.5 to 8	Colorless, Blue, Green, Yellow	India S. America Siberia	In limestone
SPINEL	Alumina . . . . . 71.99 Magnesia 28.01	8	Red, Blue, Green, Pink, Orange, Brown, also Black	Ceylon Siam Burma	Occurs in granular limestone, gneiss, and volcanic rocks
TOURMALINE	Silica combined with oxides or iron, magnesium, manganese, and aluminum, and boron in different proportions. Very variable.	7 to 7.5	Red, Blue, Green, Brown, Yellow, and Black	California Siberia Ceylon Ava Brazil	In granite, gneiss, mica slate, chlorite slate, and granular limestone

TABLE OF PRECIOUS AND SEMIPRECIOUS STONES—*Continued*

Name of Gem	Chemical Composition	Hardness	Color	Principal Localities	Occurrence
ALEXANDRITE	Alumina . . . . . 80.2 Glucina 19.8	8.5	Yellow, Brown, Sage Green	Ceylon Brazil The Urals	In association with zircons, sapphires, etc.
AMETHYST	Silica 100	7	Purple	India Spain Siberia	Found in all igneous rocks
MOONSTONE	Silica . . . . . 65.69 Alumina . . . . . 17.97 Potash . . . . . 13.99 Lime . . . . . 1.34 Soda 1.01	6	Colorless and Bluish White	Ceylon	In granite rocks
TURQUOISE	Alumina . . . . . 44.6 Phosphoric Acid . . . 30.8 Oxide of Copper . . . 3.7 Protoxide of Iron . . . 1.9 Water . . . . . 19.	6	Sky Blue	Persia Egypt N. Mexico	Probably resulted from the alteration of apatite
OPAL	Hydrous Silica	5.5 to 6.5	Almost colorless (Iridescent)	Queensland N. S. Wales Hungary Mexico	In ferruginous sandstone
GARNET	Silica . . . . . 35.5 Alumina . . . . . 21. Oxide of Iron . . . . 35.5 Oxide of Manganese . 1.5 Magnesia . . . . . 4. Lime . . . . . 2.5 Very variable	6.5 to 7.5	Many shades of Red and Brown, also Green	Brazil India Ceylon Australia S. Africa	In alluvial deposits, and in gneiss, mica schist, etc.
TOPAZ	Silica . . . . . 33.3 Alumina . . . . . 51.7 Fluorine 15.	8	Colorless, Yellow, Brown, Blue, Pink	Brazil Peru Siberia Saxony	Frequently imbedded in quartz